BEYOND POPULATION – USING DIFFERENT TYPES OF DENSITY TO UNDERSTAND LAND USE

Activity Items

The following items are part of this activity and appear at the end of this student version.

- Item 1: Beyond Population: Definitions
- Item 2: Density Analysis Images

This activity also uses the following online tools:

- U.S. Census Interactive Map – "I-95 Population Density Profile, 2010"
  www.census.gov/library/visualizations/2012/comm/pop-density-I95-2010_012.html

- U.S. Census Interactive Map – "I-5 Population Density Profile, 2010"
  www.census.gov/library/visualizations/2012/comm/pop-density-I5-2010_025.html

- U.S. Census Interactive Map – "I-10 Population Density Profile, 2010"
  www.census.gov/library/visualizations/2012/comm/pop-density-I10-2010_030.html

- U.S. Census Interactive Map – "I-90 Population Density Profile, 2010"
  www.census.gov/library/visualizations/2012/comm/pop-density-I90-2010_031.html

Student Learning Objectives

- I will be able to identify and explain where and why density is highest along four major U.S. interstates.
- I will be able to calculate arithmetic (population), agricultural, and physiological densities at the state and national levels.
- I will be able to design and create bar graphs to visualize and compare the density levels of a U.S. state with national levels.

United States Census Bureau

STATISTICS IN SCHOOLS

NAME:_____   DATE:_____

Part 1 – Understand and Observe Density in America

Using what you know about population density, answer the questions below:

1. How would you calculate the population density of our classroom?

2. How would you calculate the population density of our classroom if the population of our class doubled?

3. What issues might we face if we doubled the density of our classroom?

Watch the U.S. Census Bureau interactive map animations listed in the Activity Items section to complete the table below. These maps display the population density of cities along four major U.S. interstates. When you are done, compare your table with a partner.

Interstate	Relative Location	Density Patterns Observed	Implications of Density	Explanations for Density
I-95				
I-5				

Interstate	Relative Location	Density Patterns Observed	Implications of Density	Explanations for Density
I-10				
I-90				

Part 2 – Define Density Types

Follow along as your teacher reviews the definitions and images in **Item 1: Beyond Population: Definitions** to complete the table below.

TYPES OF DENSITY

TYPE	DEFINITION	FORMULA
ARITHMETIC		
AGRICULTURAL*		
PHYSIOLOGICAL		

Follow along as your teacher reviews the images in **Item 2: Density Analysis Images**. Complete the table below with your expectations for each area's arithmetic, agricultural, or physiological density (choose one type for each).

IMAGE	ANALYSIS
1	
2	
3	

*Agricultural density is usually calculated by dividing "population of farmers" by "arable land"; however, "number of farms" is used in place of "population of farmers."

Reflection Question

Why do you think policymakers and the U.S. Census Bureau are concerned about arithmetic, agricultural, and physiological densities?

Part 3 – Calculate Densities in the United States and Individual States

1. Use the density formulas you recorded in part 2 and the information provided below to complete the blank calculation sheet for the United States. Round your decimals to the nearest tenth.

UNITED STATES	
TOTAL POPULATION	318,857,056
TOTAL LAND AREA	3,531,905 square miles
TOTAL ARABLE LAND AREA	1,426,563 square miles
NUMBER OF FARMS	2,084,000

LARGEST CITIES	POPULATION	LAND AREA
New York City	8,491,079	302.64 square miles
Los Angeles	3,928,864	468.67 square miles
Chicago	2,722,389	227.63 square miles

DENSITY CALCULATION SHEET

UNITED STATES

CALCULATION	Formula (plug in numbers)	Value
PERCENTAGE OF ARABLE LAND (Arable Land/Total Land*100)		
ARITHMETIC DENSITY		
AGRICULTURAL DENSITY		
PHYSIOLOGICAL DENSITY		
ARITHMETIC DENSITY FOR New York City		
ARITHMETIC DENSITY FOR Los Angeles		
ARITHMETIC DENSITY FOR Chicago		

2. Use the density formulas you recorded in part 2 and the information provided below to complete the calculation sheet for either Florida or Texas. Round your decimals to the nearest tenth.

FLORIDA	
TOTAL POPULATION	19,893,297
TOTAL LAND AREA	53,625 square miles
TOTAL ARABLE LAND AREA	14,844 square miles
NUMBER OF FARMS	47,600

LARGEST CITIES	POPULATION	LAND AREA
Jacksonville	853,382	747.00 square miles
Miami	430,332	35.87 square miles
Tampa	358,699	113.41 square miles

DENSITY CALCULATION SHEET

STATE: FLORIDA

CALCULATION	Formula (plug in numbers)	Value
PERCENTAGE OF ARABLE LAND (Arable Land/Total Land*100)		
ARITHMETIC DENSITY		
AGRICULTURAL DENSITY		
PHYSIOLOGICAL DENSITY		
ARITHMETIC DENSITY FOR LARGEST CITY		
ARITHMETIC DENSITY FOR SECOND-LARGEST CITY		
ARITHMETIC DENSITY FOR THIRD-LARGEST CITY		

TEXAS	
TOTAL POPULATION	26,956,958
TOTAL LAND AREA	261,232 square miles
TOTAL ARABLE LAND AREA	203,125 square miles
NUMBER OF FARMS	245,500

LARGEST CITIES	POPULATION	LAND AREA
Houston	2,239,558	747.00 square miles
San Antonio	1,436,697	35.87 square miles
Dallas	1,281,047	113.41 square miles

DENSITY CALCULATION SHEET

STATE: TEXAS

| CALCULATION	Formula (plug in numbers)	Value
PERCENTAGE OF ARABLE LAND (Arable Land/Total Land*100)		
ARITHMETIC DENSITY		
AGRICULTURAL DENSITY		
PHYSIOLOGICAL DENSITY		
ARITHMETIC DENSITY FOR LARGEST CITY		
ARITHMETIC DENSITY FOR SECOND-LARGEST CITY		
ARITHMETIC DENSITY FOR THIRD-LARGEST CITY		

Part 4 – Graph Densities in the United States and Individual States

Now use your calculations from part 3 to create three bar graphs using the blank grids below. Label your axes appropriately, give each graph a title, and choose a different color for each variable (i.e., each location) in a set.

1. Create a bar graph that compares the percentages of arable land and nonarable land in the United States and in either Florida or Texas.
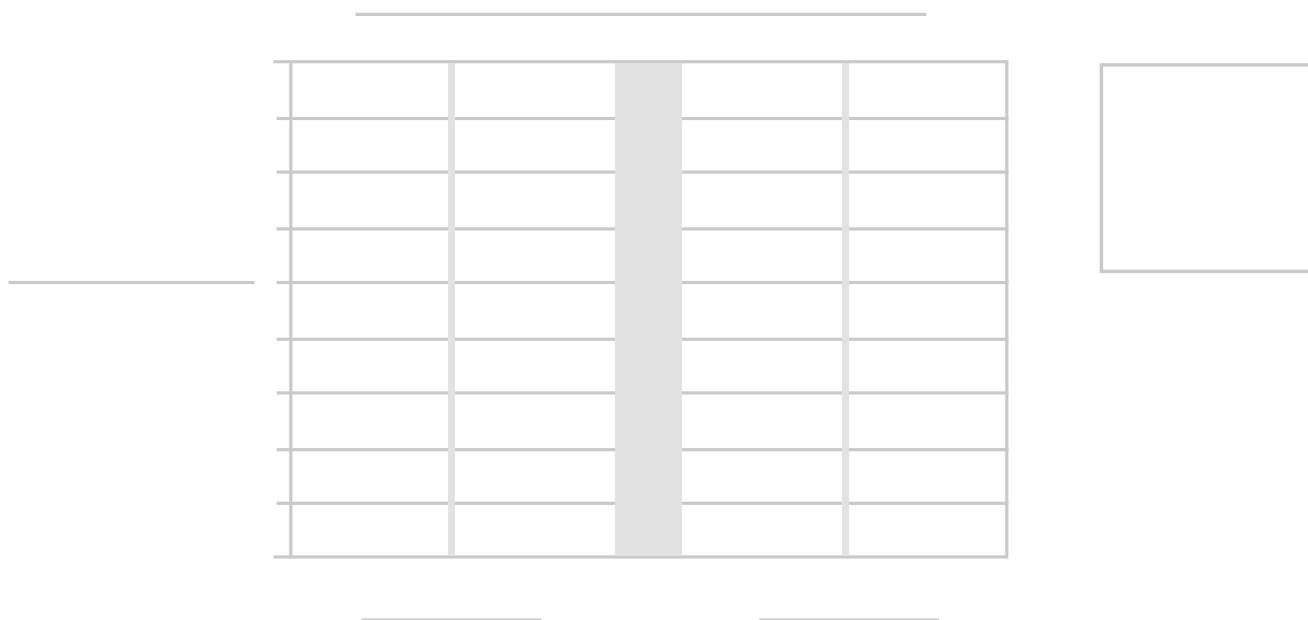
2. Create a bar graph that compares arithmetic, agricultural, and physiological densities in the United States and in either Florida or Texas.
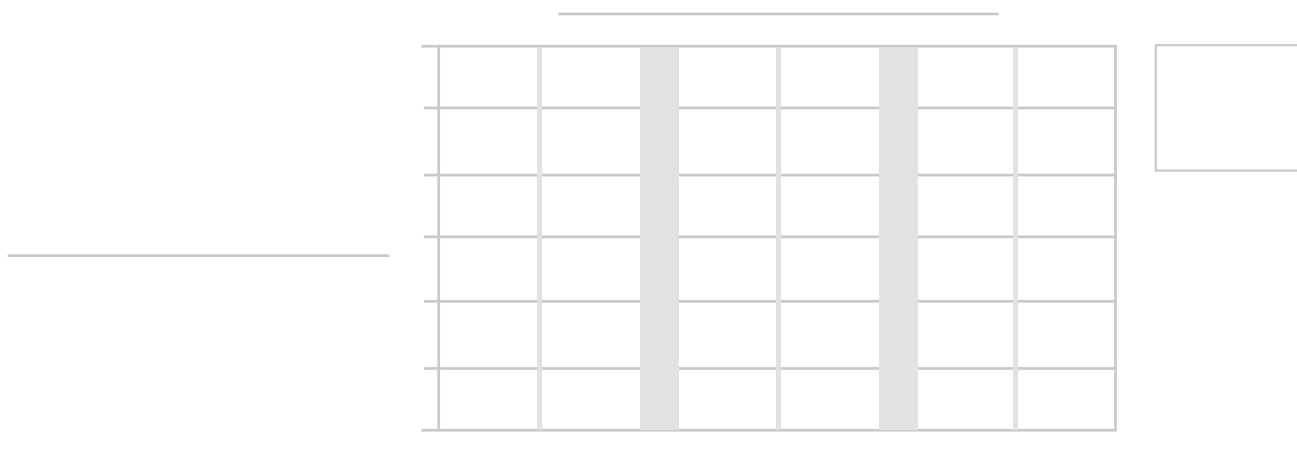
3. Create a bar graph that compares the arithmetic densities of the three largest cities in the United States with the density of either Florida or Texas.
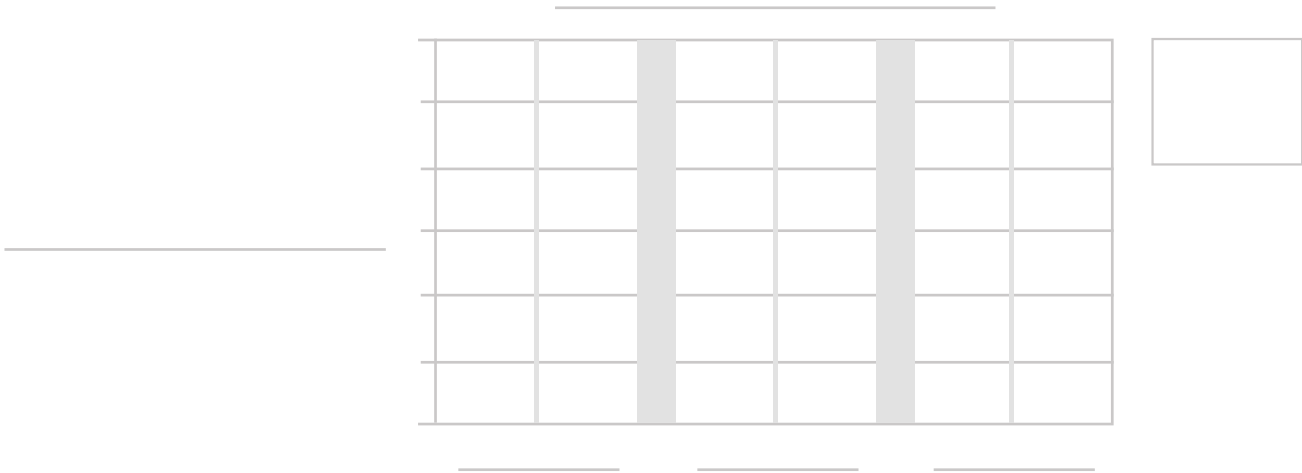
Reflection Questions

Partner with a classmate who used data from the other state to answer the following questions:

1. How are the densities and arable land percentages in your states and their cities similar? How are they different?

2. Based on the data provided, are both of your states more rural, urban, or mixed? How do you know?

3. How do the densities for both of your states compare with the densities for the United States?

Item 1: Beyond Population: Definitions

Ecumene – inhabitable land, where people have made their homes and work areas

Image #1: Ecumene in Rwanda. Notice the human-environment interactions for housing and agriculture.

Arithmetic density – the number of people per unit of area (i.e., the same as population density)

Image #2: Village in Germany with a high arithmetic density. Notice the closeness of the homes, businesses, churches, and agricultural lands.

Agricultural density – total number of farmers per unit of arable land.

Image #3: Farming in the Netherlands where urban and agricultural landscapes interact closely but agricultural density is low due to heavy-use mechanization, greenhouses, and industrial high-tech cropping of high-value crops, such as flowers.

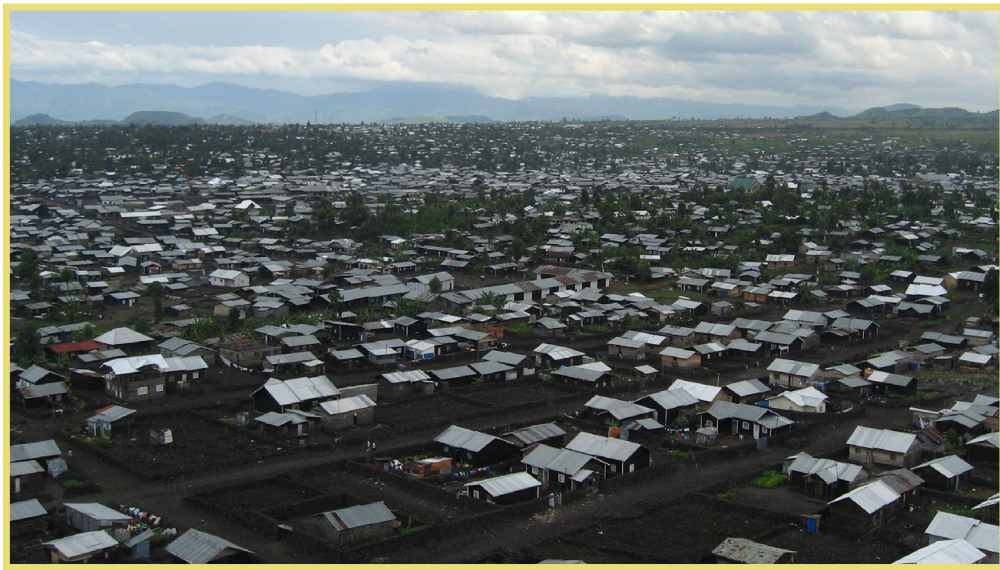### Physiological density – total population per unit of arable land.

Image #4: Refugee camp in Rwanda. Known as the "land of a thousand hillls", Rwanda has one of the highest physiological densities in the world.

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Item 2: Density Analysis Images

Image #1

Image #2

Image #3

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